

La dynamique des populations

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Introduction

Définition:

La dynamique des populations est l'étude des changements marginaux et à long terme dans les nombres, les longueurs, poids individuels et composition d'âge d'individus dans une ou plusieurs populations, et des processus biologiques et d'environnement influençant ces changements.

Une population est influencée par trois fonctions dynamiques:

1. Taux de natalité (souvent recrutement; l'atteinte d'une certaine taille ou d'une phase reproductive).
2. Taux de mortalité, qui inclut la mortalité de pêche et la mortalité naturelle.
3. Taux de croissance, qui mesure la croissance d'individus dans la taille et la longueur.

Introduction

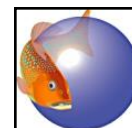
→ La dynamique des populations est cruciale pour la gestion des pêches.

Il est relativement facile à obtenir:

- la taille maximale et l'âge maximal des poissons.
- relations longueur-poids.

Il est plus difficile à obtenir:

- paramètres de croissance.
- estimations de mortalité (naturelle).
- variabilité de recrutement / séries chronologiques de recrutement.



Introduction

Ces points sont si contraignants pour la recherche halieutique tropicale qu'ils ont fourni une raison suffisante en 1987 pour proposer la création d'une base de données, qui est finalement devenue FishBase.

“un résumé des informations sur la croissance et sur la mortalité de chaque espèce [...] avec l'objectif ultime de traiter 2500 espèces.”

Mais cette prévision:

- sous-estimait le nombre d'espèces à inclure dans FishBase (maintenant 33900 espèces).
- sur-estimait le nombre d'espèces pour lesquelles des paramètres de croissance et des informations relatives existent:
 - actuellement des paramètres de croissance publiés pour un peu plus de 2000 espèces ont été répertoriés.
 - cependant, les espèces traitées pour l'instant concernent plus de 95% des captures par pêche mondiales.

De la même façon, les stocks pour lesquels plus de 750 séries chronologiques de recrutement sont incluses appartiennent aux stocks les mieux étudiés, et la plupart des stocks monospécifiques d'importance dans le monde.

Recrutement (natalité)



Recrutement (natalité)

Les fluctuations du recrutement déterminent les niveaux de captures annuels des pêcheries.

→ ces variations et leurs causes représentent une des voies principales de recherche en halieutique.

La prévision précise d'un recrutement futur n'est pas possible. Cependant, de grandes généralisations sont possibles.

exemple: les stocks épuisés produisent moins de recrues que les stocks encore abondants.

→ c'est un résultat qui n'est pas trivial.

La généralisation sera plus précise et fiable si on dispose des séries chronologiques de recrutement de diverses régions du monde.



FishBase a incorporé une base de données existante: le 'Stock Recruitment Database' de Ransom A. Myers (°1952-†2007).

www.mscs.dal.ca/~myers/welcome.html



More information				
Countries	Common names	Age/Size	References	Collaborators
FAO areas	Synonyms	Growth	Aquaculture	Pictures
Ecosystems	Metabolism	Length-weight	Aquaculture profile	Stamps, Coins
Occurrences	Predators	Length-length	Strains	Sounds
Introductions	Ecotoxicology	Length-frequencies	Genetics	Ciguatera
Stocks	Reproduction	Morphometrics	Allele frequencies	Speed
Ecology	Maturity	Morphology	Heritability	Swim. type
Diet	Spawning	Larvae	Diseases	Gill area
Food items	Fecundity	Larval dynamics	Processing	Otoliths
Food consumption	Eggs	Recruitment	Mass conversion	Brains
Ration	Egg development	Abundance	Vision	

Pour chaque espèce il y a une liste de 'stocks' pour lesquels une série de recrutement est disponible.

Un 'stock' est un groupe d'individus d'une espèce pouvant être considéré comme une entité pour des buts de gestion ou d'évaluation.

R.A. Myers et al's Recruitment Series for *Gadus morhua*
n = 32

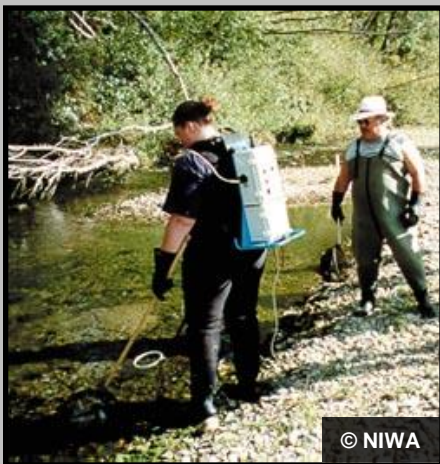
Locality	C.V. (recr.)%	Recruitment series		
		Begin	End	
NAFO 2J3KL	108.4	1850	1993	
Iceland	47.0	1905	1998	
NAFO 4TVn	50.4	1917	1993	
Faroe Plateau	68.3	1924	1995	
North East Arctic	86.3	1930	1991	
North East Arctic	75.8	1930	1991	
North East Arctic	108.5	1930	1991	
North Sea	66.0	1930	1994	
North East Arctic	80.8	1946	1993	
NAFO 4X	34.9	1948	1994	
NAFO 3NO	119.4	1953	1993	
West Greenland (NAFO 1)	705.9	1955	1992	
Greenland offshore component	710.1	1955	1992	
NAFO 3M	190.8	1956	1984	
NAFO 4VsiW	56.2	1958	1993	
NAFO 3Ps	36.5	1959	1993	
NAFO 5Y	41.7	1960	1991	
NAFO 5Y	189.0	1960	1997	
NAFO 5Z	68.1	1960	1996	
NAFO 5Z	134.4	1960	1997	
NAFO 3Pn4RS	72.3	1961	1993	
NAFO 3Pn4RS	171.2	1961	1997	
Baltic Areas 22 and 24	84.5	1965	1992	
Baltic Areas 25-32	63.7	1965	1995	
ICES VIa	49.6	1966	1993	
Irish Sea	57.7	1968	1995	
Celtic Sea	94.8	1971	1994	
Kattegat	64.9	1971	1992	
Skagerrak	35.2	1971	1992	
ICES VIII d	127.5	1976	1994	
NAFO 3M	488.0	1977	1990	
Flemish Cap (NAFO Div. 3M)	586.2	1988	1997	

Recruitment Series for *Gadus morhua*

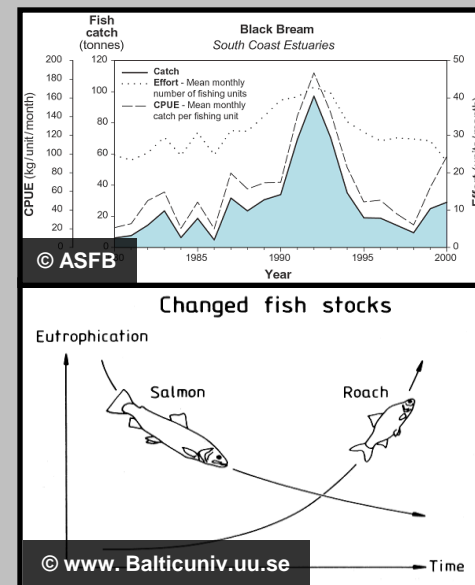
Time series graph (loading may take 2-3 mins.)
 S-R Plot (loading may take 2-3 mins.)
 Ransom A. Myers and colleagues
 Dalhousie University, Halifax, N.S., Canada

Common Name	Cod
Locality	Flemish Cap (NAFO Div. 3M) (47° N, 45° W)
Year	1988 - 1997
Country	
Method for deriving time series	SPA
Age group for estimating F	05-Mar
Age at recruitment	1 (full years)
C.V. (recr.)	586.2 %
Remarks	Natural mortality (1/y): 0.2. Spawning location: Shelf. Spawning/egg type: Oviparous, pelagic. Egg diameter: 1.4mm. Length at hatching: 3mm. Length at metamorphosis: 24mm. Change in length during larval phase: 21mm

La méthode utilisée pour déduire une série chronologique de recrutement:



- 1/ comptages directs.
- 2/ données de prise et effort.
- 3/ la pêche électrique.
- 4/ marquage et recapture.
- 5/ analyse de population virtuelle (SPA/APV).
- 6/ reconstruction du stock.
- 7/ campagne de recherche.
- 8/ (voir l'information supplémentaire).

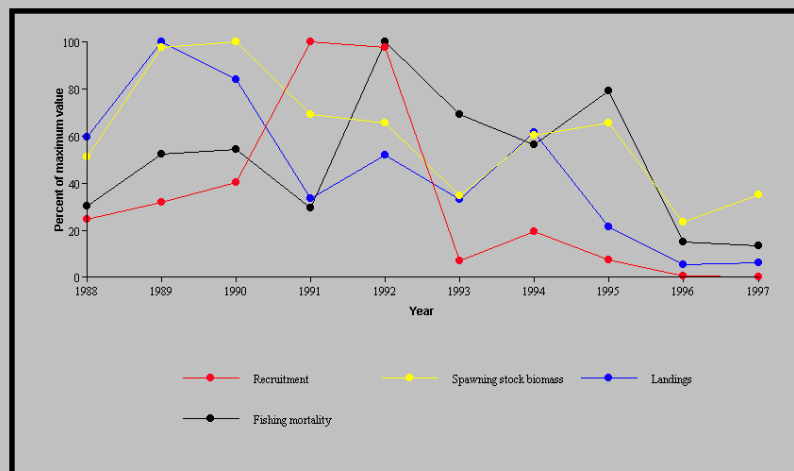


Recruitment Series for *Gadus morhua*

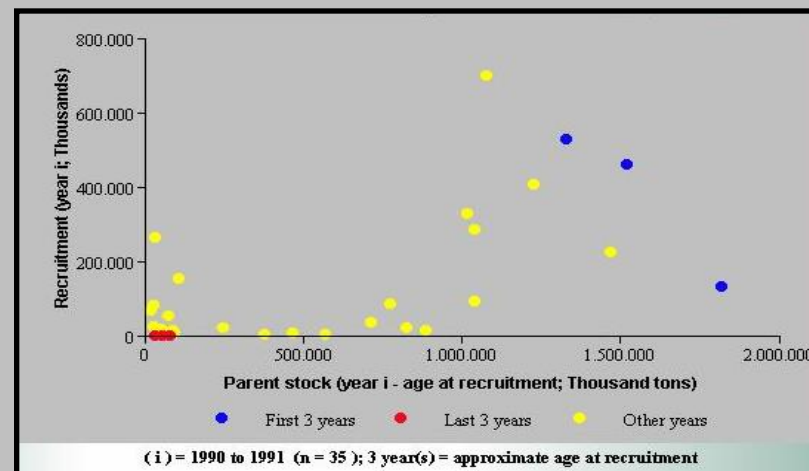
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Il est possible de faire différents graphiques dans FishBase sur base des données disponibles:



Graphique de série chronologique



Relation entre stock et recrutement

Mortalité

Louisiana (États-Unis) 2010:

Une 'zone morte' est une zone hypoxique (déficiente en oxygène dissous) situé dans un environnement aquatique. Ces zones ont des impacts de plus en plus importants sur la pêche et les écosystèmes.

Mortalité

$$Z = F + M$$

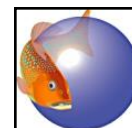
La mortalité est le taux de décès dû à diverses causes. Habituellement elle est exprimée sur base annuelle en terme de proportion de la population totale.



La mortalité totale (Z) est la mortalité des poissons provoquée par l'ensemble des différentes raisons. C'est la somme de:

- 1/ la mortalité due à la pêche (F), qui est la mortalité des poissons qui sont enlevés des populations par la pêche.
- 2/ la mortalité naturelle (M), qui est la mortalité dans les phases juvénile et adulte d'une population par prédation, maladies, pollution,...

Pour des populations inexploitées: $Z = M$

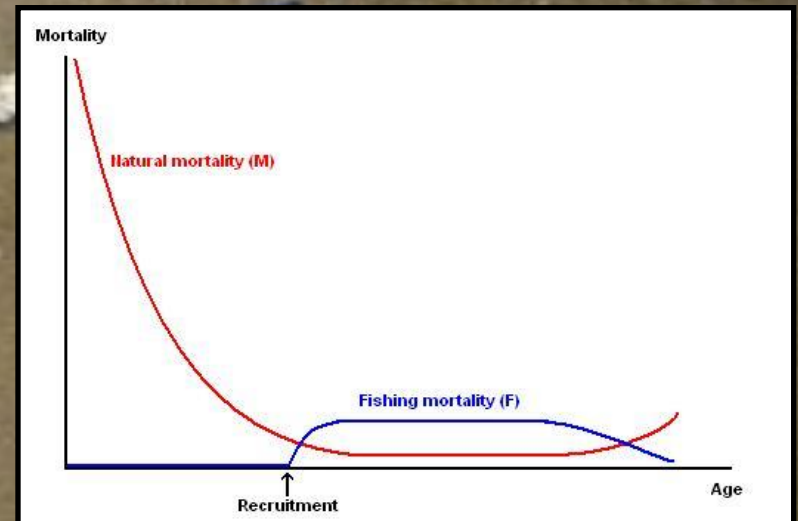


Mortalité

$$Z = F + M$$

La mortalité naturelle (M) est estimée à partir de la longueur maximale et de la température de l'eau. C'est un des paramètres les plus difficiles à estimer dans les populations exploitées. À cause de ça, on fait des estimations à partir des modèles empiriques: basées sur des paramètres de croissance, taille à première maturité, taille maximale ou âge maximal.

La mortalité due à la pêche (F) peut avoir des valeurs de 0 pour aucune pêche jusqu'à de très hautes valeurs telles que 1.5 à 2, ce qui signifie 1.5 ou 2 fois le nombre de poissons attrapés aux poissons qui était présent au départ de la saison de la pêche.



Âge et taille maximaux

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List of Population Characteristics records for *Bagrus docmak*

n = 5

Sex	Wmax	Lmax (cm)	Tmax (y)	Country	Locality
unsexed	46.0 kg			Uganda	Murchison Falls, Victoria Nile, unknown
unsexed	5.3 kg	71		Chad	Mayo Kebbie, Chad
unsexed	15.0 kg	110			Lake Albert
unsexed	20.0 kg	115		Congo Dem Rp	Lake Edward , 1988
unsexed	33.0 kg	120			Nile river

Population Characteristics of *Bagrus docmak*

Main Ref.	13302		
Sex	unsexed	Data Ref.	13302
Wmax	20.0 kg total weight		
Lmax (cm)	115 FL		
Tmax (y)			
Locality	Lake Edward , 1988		
Country	Congo Dem Rp		
Comments			

Âge et taille maximaux

On peut considérer cette page de FishBase comme la réponse au livre 'Guinness Book of Records'.

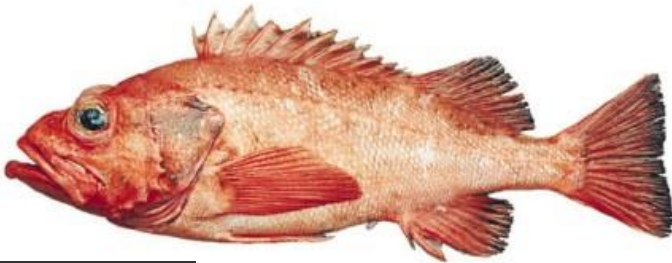
→ Le 'requin baleine' est le poisson le plus grand et le plus lourd.

© Robert Janssen

Rhincodon typus Smith, 1828

Longueur: 20 m TL

Poids: 34.000 kg



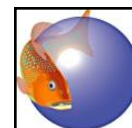
→ Le 'roughey rockfish' est le poisson le plus âgé.

Sebastes aleutianus (Jordan & Evermann, 1898)

Âge: 205 années

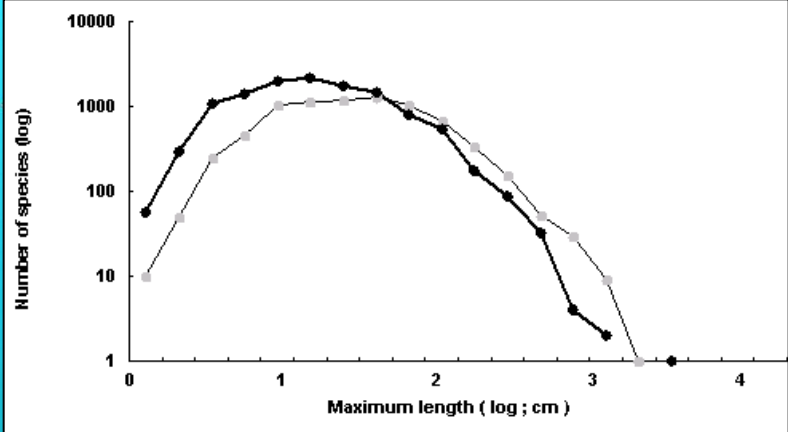
© Michael Gjernes

Musée Royal de l'Afrique Centrale (MRAC Tervuren)

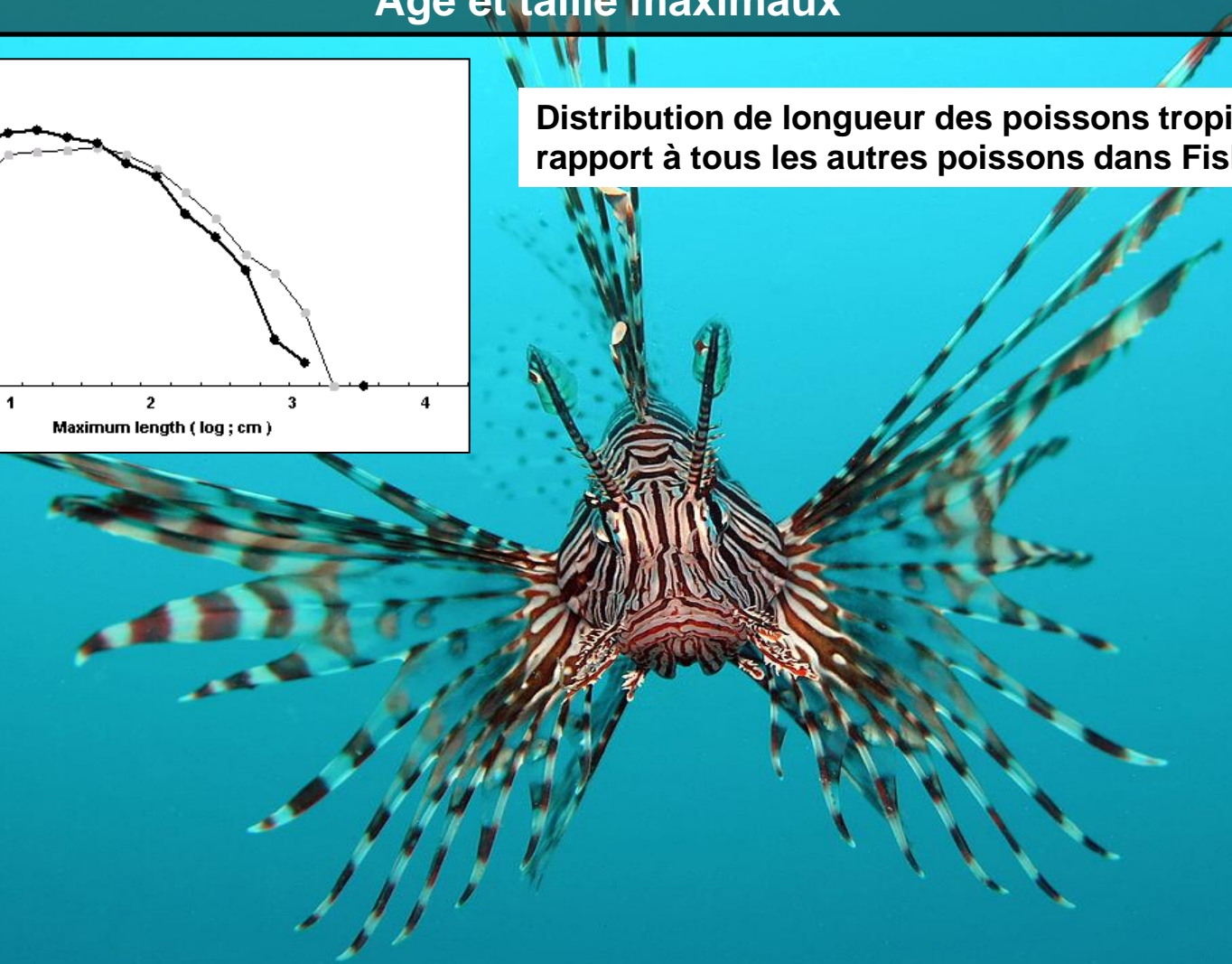


Formation "FishBase et la Taxinomie des Poissons" - Session 2018

Âge et taille maximaux



Distribution de longueur des poissons tropicaux (●) par rapport à tous les autres poissons dans FishBase (◐).



© Jens Petersen

Croissance



Musée Royal de l'Afrique Centrale (MRAC Tervuren)

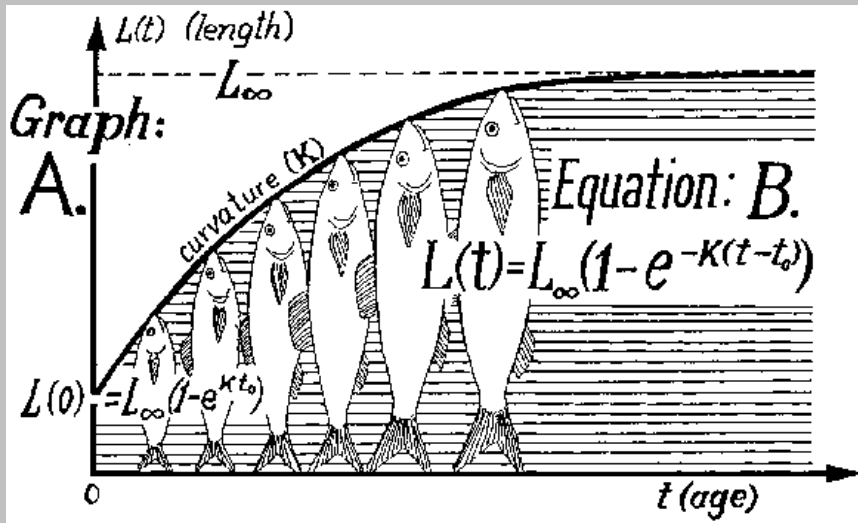


Formation "FishBase et la Taxinomie des Poissons" - Session 2018

Croissance

Les paramètres de croissance dans FishBase sont basés sur la courbe de von Bertalanffy (CVB). C'est le modèle de croissance le plus souvent utilisé pour les animaux aquatiques. Il a été introduit par Ludwig von Bertalanffy en 1838 et prévoit la longueur d'un poisson en fonction de son âge.

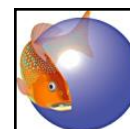
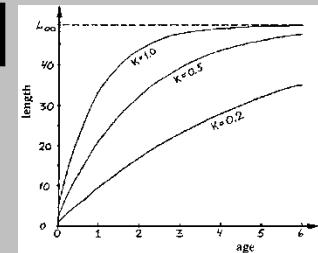
$$L_t = L_{\infty}(1 - e^{-K(t - t_0)})$$



L_t = la longueur moyenne prédite pour un individu d'une population donnée à l'âge t .
 L_{∞} = la longueur asymptotique moyenne (la longueur à un âge infini).
 K = le coefficient de croissance (avec des unités de temps réciproques).
 t_0 = l'âge théorique (et généralement négatif) pour une longueur nulle, obtenu par extrapolation de la CVB.

K s'appelle souvent une constante de croissance, mais il pourrait changer lorsque les poissons vieillissent.

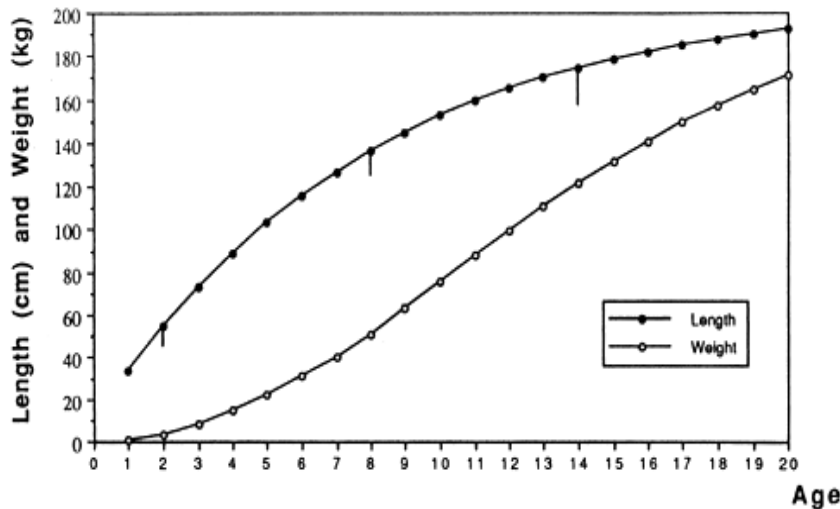
$$K = (dL / dt) / (L_{\infty} - L)$$



Croissance

Corrélativement, la courbe de von Bertalanffy (CVB) s'exprime pour la croissance en poids.

$$W_t = W_\infty (1 - e^{-K(t-t_0)})^b$$



W_t = le poids moyenne prédite pour un individu d'une population donnée à l'âge t .

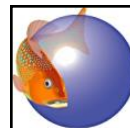
W_∞ = le poids asymptotique moyenne (le poids à un âge infini).

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b = le coefficient extrait d'une relation entre la longueur et le poids.

$$W = a L^b$$



Croissance

- Les modèles de croissance qui ne considèrent pas explicitement les oscillations saisonnières omettent un aspect essentiel du processus de croissance.
- De plus, même en milieu tropicale, la faible différence de température de 2°C entre hiver et été suffit à induire des oscillations saisonnières de croissance qui restent statistiquement significatives bien que visuellement indétectables.
- Le modèle de croissance qui rend compte au mieux des oscillations saisonnières de croissance est probablement celui de Somer (1988):

$$L_t = L (1 - e^{-(K(t-t_0) + S_t - S_{t_0})})$$

L_t = la longueur moyenne prédite pour un individu d'une population donnée à l'âge t .

K = le coefficient de croissance (avec des unités de temps réciproques).

t_0 = l'âge théorique (et généralement négatif) pour une longueur nulle, obtenu par extrapolation de la CVB.

Définis comme dans la CVB standard.

$$S_t = (C \frac{K}{2\pi}) \sin\pi(t - t_s)$$

t_s = la durée entre $t=0$ et le début d'une oscillation sinusoïdale de croissance.

$$S_{t_0} = (C \frac{K}{2\pi}) \sin\pi(t_0 - t_s)$$

Pour se le représenter, il est utile de définir un 'point hivernal' (WP, Winter Point) qui exprime la période de l'année où la croissance est la plus lente.

$$WP = t_s + 0,5$$

Le WP est souvent proche de 0,1 dans l'hémisphère nord (mi-février) et de 0,6 dans l'hémisphère sud (mi-août), d'où son nom.

Croissance

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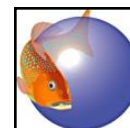
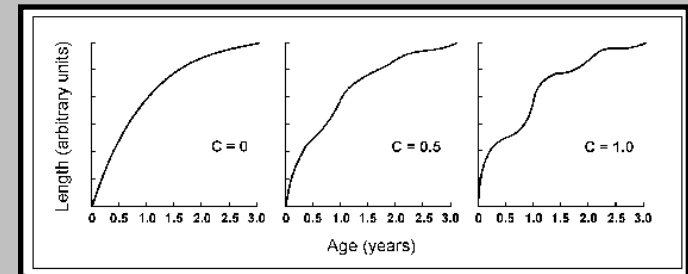
$$L_t = L (1 - e^{-(K(t-t_0) + S_t - S_{t_0})})$$

C exprime l'amplitude des oscillations de croissance et est le plus facile à interpréter:

- Quand C=0, l'équation devient la CVB standard.
- Quand C=0,5, les oscillations saisonnières de croissance sont telles que la croissance est augmentée de 50% au moment du pic de croissance en été, et (brièvement) réduite de 50% en hiver.
- Quand C=1, la croissance varie de 100%, c'est-à-dire qu'elle double en été, et devient nulle en plein hiver.

$$S_t = (C \frac{K}{2\pi}) \sin^{\pi}(t - t_s)$$

$$S_{t_0} = (C \frac{K}{2\pi}) \sin^{\pi}(t_0 - t_s)$$



Relation Longueur-Poids (L-W)

$$W = a L^b$$

W = le poids total du poisson (g).

L = la longueur totale du poisson (cm).

a = un facteur de condition, pour comparer des poissons de même espèce. Il varie entre espèces et peut changer suivant le sexe ou la saison.

b = un exposant décrivant la croissance.

Le facteur de condition de Fulton (K):

$$K = \frac{10^N W}{L^3}$$

Exemple: *Salmo trutta* Linnaeus, 1758



K=1.60 – la condition est excellente

K=1.40 – la condition est bonne

K=1.20 – la condition est juste

K=1.00 – la condition est faible

K=0.80 – la condition est extrêmement faible

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Relation Longueur-Poids (L-W)

$$W = a L^b$$

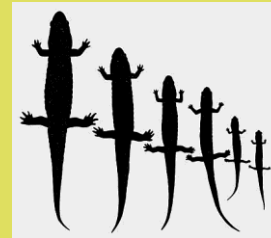
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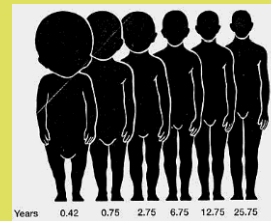
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b = un exposant décrivant la croissance.

1/ $b=3$: la croissance est isométrique et l'organisme se développera uniformément. Le poisson a une forme de corps cohérente et une gravité spécifique.



2/ $b>3$ ou $b<3$: la croissance est allométrique (positif ou négatif). Il y a une croissance différente d'une partie de l'organisme en relation avec la croissance de l'organisme entier ou d'une autre partie de celui-ci.



© www.harding.edu

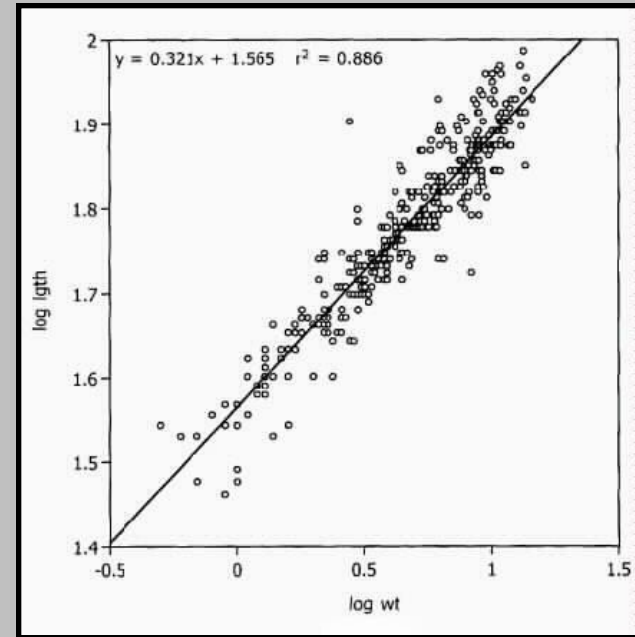
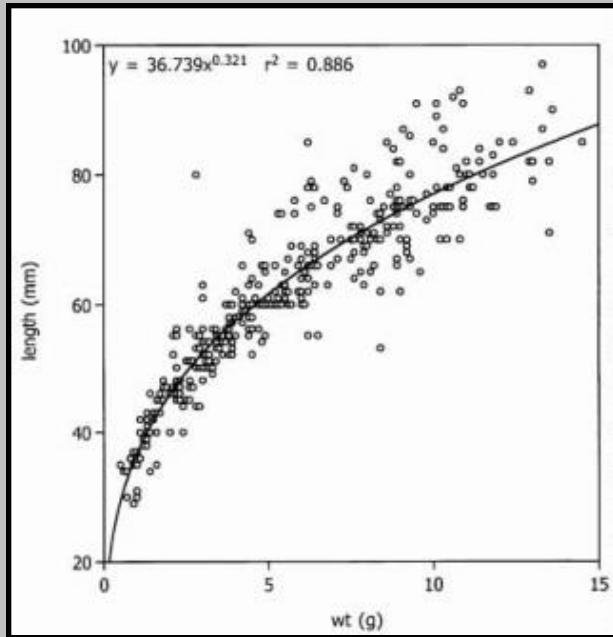
Croissance

Relation Longueur-Poids (L-W)

$$W = a L^b$$

Après log-transformation

$$\log W = \log a + b \log L$$



Relation Longueur-Poids (L-W)

More information

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FishBase contient l'information sur la relation entre la longueur et le poids dans différentes populations.

Length-Weight Parameters for *Bagrus docmak*

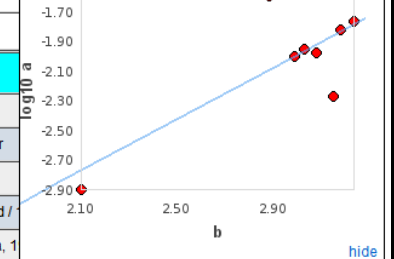
Length-weight (log a vs b) graph

[n=8]

[Hide graph](#)

Sort by a b Country Locality

Score	a	b	Doubtful?	Sex	Length (cm)	Length type	r ²	SD b	SD log ₁₀ a	n	Country	
0.50	0.00126	2.100		male							Egypt	Assiut, 1993
0.50	0.02530	2.880		mixed								Lake Nasser
0.96	0.01000	2.987		unsexed	8.4 - 32.0	SL	0.956			123	Ghana	Volta River
0.97	0.01100	3.028		unsexed	27.5 - 48.2	FL	0.968			50	Congo Dem Rp	Lake Edward /
0.70	0.01040	3.076		unsexed	14.4 - 70.1	FL				139	Tanzania	Lake Victoria, 1
0.99	0.00529	3.149		unsexed	13.0 - 37.5	TL	0.988			16	Benin	Ouémé River Basin, 1999-2001
0.50	0.01510	3.180		mixed							Egypt	Assiut, 1993
0.50	0.01710	3.233		female							Egypt	Assiut, 1993



[Refresh](#) [Download selected data](#) [Bayesian analysis](#)

Preliminary parameter estimates are provided below, based on your selection of studies and weighted by the scores. You may want to exclude or give less weight to studies that are far from the regression line in the graph.

Selected studies = 8, **geometric mean a** = 0.0089, **mean b** = 2.98, **SD log₁₀(W)** = 0.0000, **SD log₁₀(a)** = 0.3254 **SD b** = 0.2927

Estimate weight for given length: 0.0 (cm) = 0.00 (g) 95% range 0.00 - 0.00 (g)

[Include Genus](#) [Include Family](#)

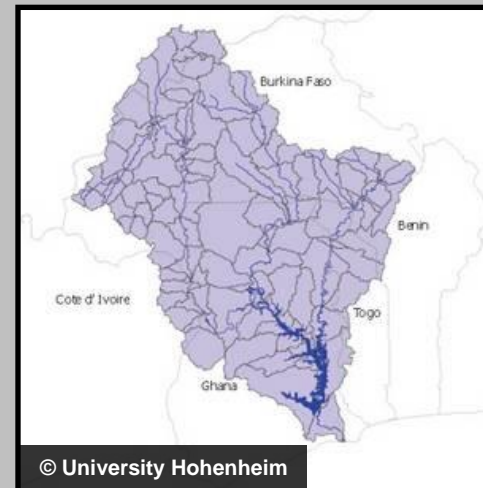
Search for more references on length-weight: [Scirus](#)

[Back to Search](#) | [Back to Top](#)

Relation Longueur-Poids (L-W)

Length-Weight Relationship for *Bagrus docmak*

Main Ref. :	8992	
Data Ref. :	8992	
Length (cm) :	8.4 - 32.0 SL	
Number of fish :	123	
Sex of fish :	unsexed	
Method :	type I linear regression	
a :	0.01000	95% confidence limit.
b :	2.987	95% confidence limit.
r ² :	0.956	
Estimate doubtful ? :		
Locality :	Volta River	
Country :	Ghana	
Comments :		
Calculated weight :	10	cm SL => 9.71 g <input type="button" value="Recalculate"/>



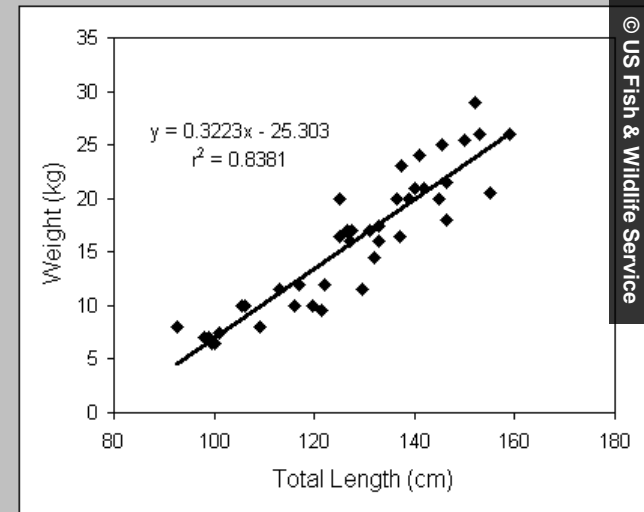
Il y a différentes méthodes pour déterminer les valeurs a et b:

- 1/ régression linéaire type I – régression linéaire de logW en fonction de logL (prédicatif).
- 2/ régression linéaire type II – régression linéaire de logW en fonction de logL (fonctionnel).
- 3/ régression non-linéaire de W en fonction de L.
- 4/ algorithme de Pauly & Gayanilo (1996) – échantillons de longueur-fréquence et de leurs poids.
- 5/ calcul de la constante a avec un seul couple de valeurs L-W pour b=3.
- 6/ calcul de la constante a en utilisant les moyennes géométriques des valeurs L et W pour b=3.
- 7/ tout autre méthode (spécifié dans le champ ‘comment’).

Relation Longueur-Poids (L-W)

Length-Weight Relationship for *Bagrus docmak*

Main Ref.:	8992	
Data Ref.:	8992	
Length (cm):	8.4 - 32.0 SL	
Number of fish:	123	
Sex of fish:	unsexed	
Method:	type I linear regression	
a:	0.01000	95% confidence limit:
b:	2.987	95% confidence limit:
r ² :	0.956	
Estimate doubtful ?:		
Locality:	Volta River	
Country:	Ghana	
Comments:		
Calculated weight:	10 cm SL => 9.71 g	<input type="button" value="Recalculate"/>



La relation entre la longueur et le poids peut être prévue. Cette prévision ne sera pas parfaite, nous devons donc pouvoir donner la force de cette relation (ou comment la ligne adapte les données).

r = coefficient de corrélation. Il indique à quel point les paires de nombres pour les deux variables se trouvent sur une ligne droite.

- $r = \pm 1$: linéarité parfaite.
- $r > 1$: la tendance est ascendante.
- $r < 1$: la tendance est descendante.

S'il n'y a aucune tendance linéaire, r est près de 0. Une corrélation de 0,9 est très forte.

Relation Longueur-Poids (L-W)

Length-weight (log a vs b) graph

Length-Weight Parameters for *Bagrus docmak* [n=8] Hide graph

Sort by a b Country Locality

Score	a	b	Doubtful?	Sex	Length (cm)	Length type	r ²	SD b	SD log ₁₀ a	n	Country	
0.50	0.0126	2.100		male							Egypt	Assiut, 1993
0.50	0.0530	2.880		mixed								Lake Nasser
0.96	0.0000	2.987		unsexed	8.4 - 32.0	SL	0.956			123	Ghana	Volta River
0.07	0.0000	2.028		unsexed	27.5 - 48.2	FL	0.968			50	Congo Dem Rp	Lake Edward /
0.1										139	Tanzania	Lake Victoria, 1
0.1										16	Benin	Ouémé River Basin, 1999-2001
0.1											Egypt	Assiut, 1993
0.1											Egypt	Assiut, 1993

Length-weight (log a vs b) of *Bagrus docmak* and Bagridae

- Miscellaneous species
- Family
- Current species
- Current estimate

[n = 9746; mean a = 0.0092; b = 2.93]

Add estimate: a = 0.0092 b = 2.93

Include Miscellaneous species

[Length-weight parameters list](#) [Back to Search](#)

Back to Top

Comparaisons possibles avec d'autres espèces diverses, espèces de la même famille ou espèces courantes.

Relation Longueur-Longueur (L-L)

More information

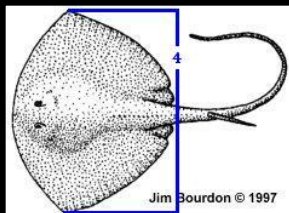
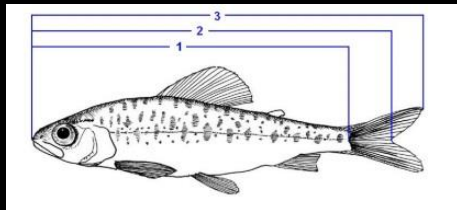
Countries	Common names	Age/Size	References	Collaborators
FAO areas	Synonyms	Growth	Aquaculture	Pictures
Ecosystems	Metabolism	Length-weight	Aquaculture profile	Stamps, Coins
Occurrences	Predators	Length-length	Strains	Sounds
Introductions	Ecotoxicology	Length-frequencies	Genetics	Ciguatera
Stocks	Reproduction	Morphometrics	Allele frequencies	Speed
Ecology	Maturity	Morphology	Heritability	Swim. type
Diet	Spawning	Larvae	Diseases	Gill area
Food items	Fecundity	Larval dynamics	Processing	Otoliths
Food consumption	Eggs	Recruitment	Mass conversion	Brains
Ration	Egg development	Abundance	Vision	

Length-length Parameters for *Bagrus docmak*

Unknown length	a	b	Known length	r	Length range (cm)	Sex of fish
TL	0.000	1.177	FL		-	unsexed
TL	1.507	1.194	SL		-	unsexed
TL	0.000	1.260	SL		-	unsexed
TL	0.233	1.271	SL	0.991	13 - 37.5	unsexed

Length-Length Relationship for *Bagrus docmak*

Sex of fish :	unsexed	
Regression :	TL = 1.507 + 1.194 x SL	
Number of fish :		r :
Length (cm) :	-	Data Ref. : 8992
Comments :		



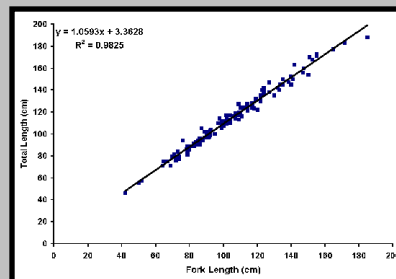
1. SL = longueur standard
2. FL = longueur à la fourche
3. TL = longueur totale
4. DW = largeur du disque

Les formules pour la conversion d'un type de longueur à l'autre:

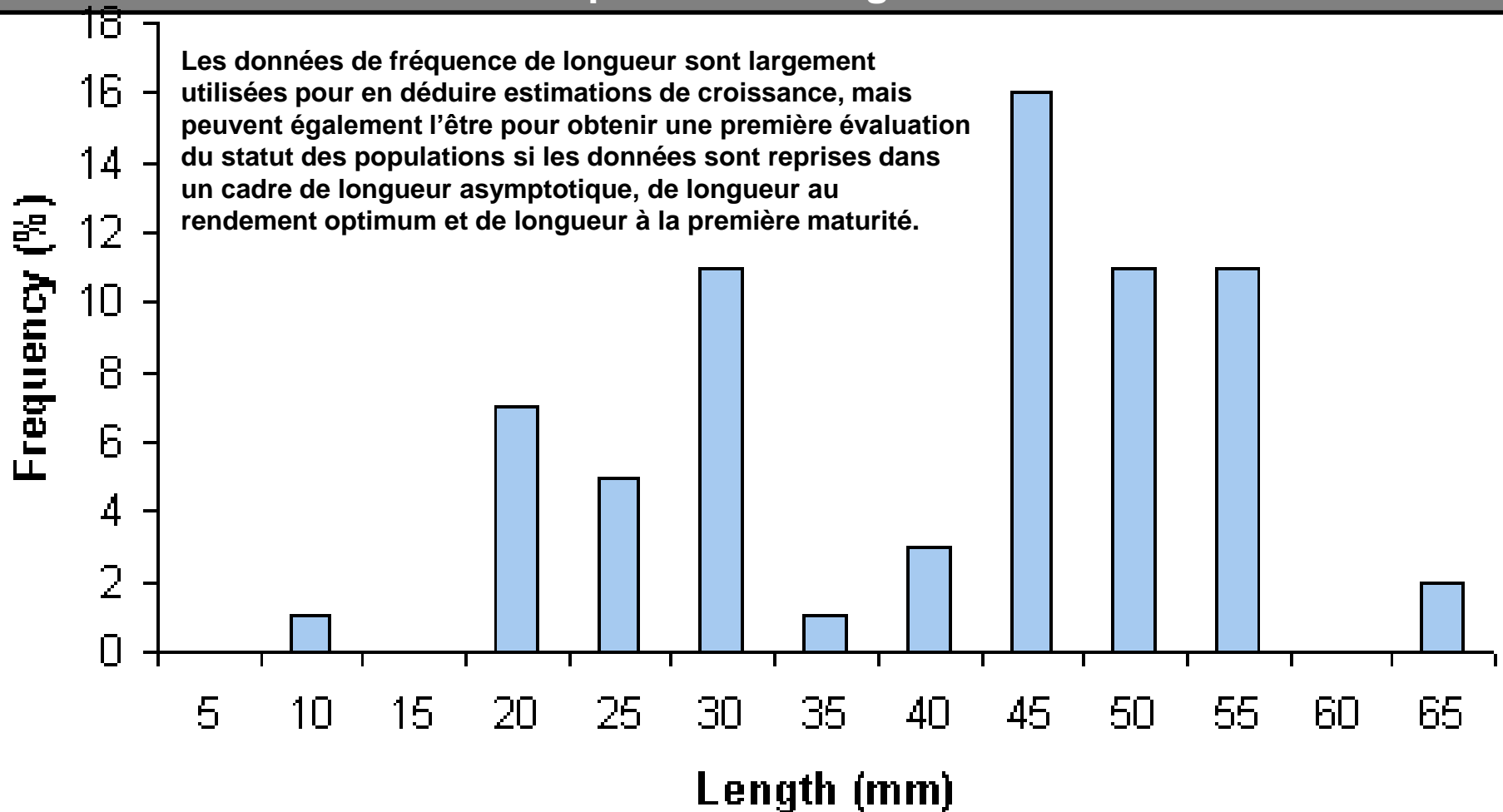
1/ Type de longueur (2) = a + b * type de longueur (1)

2/ Type de longueur (2) = r * type de longueur (1)

[La plupart du temps estimé pour un spécimen singulier]



Fréquences de longueur



Fréquences de longueur

More information

Countries	Common names	Age/Size	References	Collaborators
FAO areas	Synonyms	Growth	Aquaculture	Pictures
Ecosystems	Metabolism	Length-weight	Aquaculture profile	Stamps, Coins
Occurrences	Predators	Length-length	Strains	Sounds
Introductions	Ecotoxicology	Length-frequencies	Genetics	Cigarettes
Stocks	Reproduction	Morphometrics	Allele frequencies	Speed
Ecology	Maturity	Morphology	Heritability	Swim. type
Diet	Spawning	Larvae	Diseases	Gill area
Food items	Fecundity	Larval dynamics	Processing	Otoliths
Food consumption	Eggs	Recruitment	Mass conversion	Brains
Ration	Egg development	Abundance	Vision	

List of frequency studies for *Brycinus sadleri*

Locality	Year from - to	Sex	Gear	Frequency type
Lac Victoria, Kenya	1985 - 1985	unsexed/mixed	other	absolute number measured
Nyanza Gulf, Lake Victoria, Kenya	1985 - 1986	unsexed/mixed	trawls	raised to the catch

[Back to Search](#)

L_m = la longueur à première maturité.

L_{opt} = la longueur optimale.

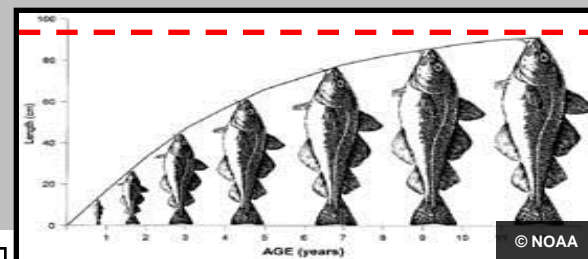
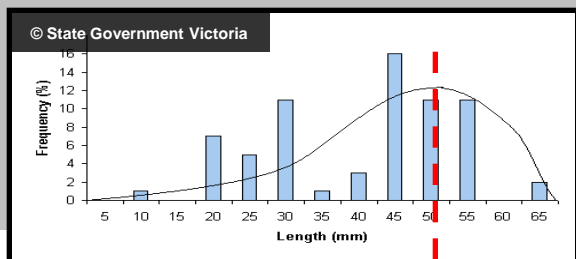
La classe de longueur où le produit du survivant et le poids moyen est maximal pour une population non-pêchée. La biomasse de la classe est maximale à cette longueur.

$L_{infinity} = L_{\infty}$ = la longueur asymptotique.

La longueur moyenne qu'un poisson d'une certaine population peut atteindre s'il lui était possible de se développer pendant une période infiniment longue.

Length frequency of *Brycinus sadleri*

Main Ref:	Moreau, J., M.L.D. Palomares, F.S.B. Torres and D. Pauly, 1995			
Locality:	Lac Victoria Kenya			
Latitude:		Longitude:		Accuracy:
Depth:		Temp:	28-	Sex:
Gear:	other	Specific gear used:		unsexed/mixed
Lm (cm):		Lopt:	7.566	L(infinity) (cm):
Lc (cm):		F:		M:
Z:	1.76	E:		Unexploited:
a:		b:		Ref:
Length:	3.75 - 12.25 cm TL			
Frequency type:	absolute number measured			Data type
Year:	1985 - 1985			
LF Data				
Comments:				
Parameters from Growth record:				
L (infinity)	13.7	K	0.46	Ref:
			1472	M
				Ref:



Fréquences de longueur

More information

Countries	Common names	Age/Size	References	Collaborators
FAO areas	Synonyms	Growth	Aquaculture	Pictures
Ecosystems	Metabolism	Length-weight	Aquaculture profile	Stamps, Coins
Occurrences	Predators	Length-length	Strains	Sounds
Introductions	Ecotoxicology	Length-frequencies	Genetics	Ciguatera
Stocks	Reproduction	Morphometrics	Allele frequencies	Speed
Ecology	Maturity	Morphology	Heritability	Swim. type
Diet	Spawning	Larvae	Diseases	Gill area
Food items	Fecundity	Larval dynamics	Processing	Otoliths
Food consumption	Eggs	Recruitment	Mass conversion	Brains
Ration	Egg development	Abundance	Vision	

List of frequency studies for *Brycinus sadleri*

Locality	Year from - to	Sex	Gear	Frequency type
Lac Victoria, Kenya	1985 - 1985	unsexed/mixed	other	absolute number measured
Nyanza Gulf, Lake Victoria, Kenya	1985 - 1986	unsexed/mixed	trawls	raised to the catch

[Back to Search](#)

F = la mortalité de pêche.
 M = la mortalité naturelle.
 Z = la mortalité totale.

$$Z = F + M$$

a / b = les paramètres de la relation longueur-poids obtenus ou calculés directement des échantillons.

$$W = a L^b$$

Length frequency of *Brycinus sadleri*

Main Ref:	Moreau, J., M.L.D. Palomares, F.S.B. Torres and D. Pauly, 1995		
Locality:	Lac Victoria Kenya		
Latitude:	Longitude:	Accuracy:	
Depth:	Temp:	Sex:	unsexed/mixed
Gear:	other	Specific gear used:	
Lm (cm):	Lopt:	7.566	L(infinity) (cm): 13.7
Lc (cm):	F:		M: 1.59
Z:	1.76	E:	Unexploited: <input type="checkbox"/>
a:	b:		Ref:
Length:	3.75 - 12.25 cm TL		
Frequency type:	absolute number measured	Data type	survey data
Year:	1985 - 1985		
LF Data			
Comments:			
Parameters from Growth record:			
L (infinity)	13.7	K	0.46
Ref:	1472	M	Ref:

Fréquences de longueur

Length frequency of *Brycinus sadleri*

Main Ref:	Moreau, J., M.L.D. Palomares, F.S.B. Torres and D. Pauly, 1995		
Locality:	Lac Victoria Kenya		
Latitude:	Longitude:	Accuracy:	
Depth:	Temp:	28-	Sex: unsexed/mixed
Gear:	other Specific gear used:		
Lm (cm):	Lopt:	7.566	L(infinity) (cm): 13.7
Lc (cm):	F:		M: 1.59
Z:	E:		Unexploited: <input type="checkbox"/>
a:	b:		Ref:
Length:	3.75 - 12.25 cm TL		
Frequency type:	absolute number measured	Data type	survey data
Year:	1985 - 1985		
LF Data			
Comments:			
Parameters from Growth record:			
L (infinity)	13.7	K	0.46
Ref:	1472	M	Ref:

Gréement: indication du type de gréement utilisé pour la pêche.

1/ chaluts

2/ dragues

3/ seines

4/ épuisettes

5/ courbures

6/ éperviers

7/ pièges à poissons

8/ hameçons



Fréquences de longueur

Length frequency of *Brycinus sadleri*

Main Ref:	Moreau, J., M.L.D. Palomares, F.S.B. Torres and D. Pauly, 1995		
Locality:	Lac Victoria Kenya		
Latitude:	Longitude:	Accuracy:	
Depth:	Temp:	28-	Sex: unsexed/mixed
Gear:	other	Specific gear used:	
Lm (cm):	Lopt:	7.566	L(infinity) (cm): 13.7
Lc (cm):	F:		M: 1.59
Z:	1.76	E:	Unexploited: <input type="checkbox"/>
a:	b:		Ref:
Length:	3.75 - 12.25 cm TL		
Frequency type:	absolute number measured		Data type: survey data
Year:	1985 - 1985		
Comments:	LF Data		
Parameters from Growth record:			
L (infinity)	13.7	K	0.46
Ref:	1472	M	Ref:

Frequency Distribution

LF Code 399	Sampling											Summation
	LF Wizard	LF Wizard	LF Wizard	LF Wizard	LF Wizard	LF Wizard	LF Wizard	LF Wizard	LF Wizard	LF Wizard	LF Wizard	
3.75	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.0	1.0	1.0	7.0
4.25	11.0	1.0	6.0	1.0	1.0	0.0	3.0	25.0	0.0	14.0	62.0	
4.75	44.0	20.0	31.0	11.0	9.0	10.0	17.0	40.0	2.0	24.0	208.0	
5.25	69.0	116.0	55.0	32.0	18.0	29.0	32.0	50.0	12.0	28.0	441.0	
5.75	22.0	150.0	112.0	37.0	10.0	83.0	62.0	55.0	15.0	51.0	597.0	
6.25	10.0	148.0	102.0	82.0	57.0	83.0	62.0	18.0	27.0	24.0	613.0	
6.75	1.0	65.0	24.0	61.0	65.0	49.0	24.0	8.0	37.0	14.0	348.0	
7.25	9.0	6.0	5.0	24.0	35.0	44.0	19.0	33.0	91.0	6.0	272.0	
7.75	53.0	7.0	40.0	8.0	24.0	29.0	11.0	61.0	96.0	24.0	353.0	
8.25	52.0	36.0	80.0	6.0	43.0	5.0	19.0	43.0	12.0	38.0	334.0	
8.75	78.0	50.0	48.0	28.0	38.0	21.0	33.0	22.0	17.0	55.0	390.0	
9.25	31.0	48.0	44.0	48.0	26.0	31.0	34.0	4.0	25.0	29.0	320.0	
9.75	18.0	21.0	20.0	22.0	7.0	40.0	60.0	2.0	61.0	20.0	271.0	
10.25	9.0	7.0	6.0	10.0	7.0	22.0	27.0	1.0	80.0	3.0	172.0	
10.75	9.0	3.0	7.0	3.0	5.0	14.0	17.0	1.0	60.0	1.0	120.0	
11.25	0.0	1.0	2.0	3.0	3.0	7.0	5.0	0.0	27.0	0.0	48.0	
11.75	0.0	4.0	0.0	3.0	2.0	5.0	4.0	0.0	4.0	0.0	22.0	
12.25	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	5.0	0.0	7.0	

Les données brutes pour les fréquences de longueur de la population étudié sont présentes.

Tools

E-book | Field guide | **Length-frequency wizard** | Life-history tool | Point map | Classification Tree | Catch-MSY



Length-Frequency Analysis Wizard (*Limnothrissa miodon*) (Designed by Rainer Froese in 2004)

Step 1: Introduction

In the following you will be guided through an analysis of length-frequency data, resulting in an estimation of the degree of exploitation, and an indication of how much more could be caught with a different fishing strategy. For advanced users we also provide an approach to estimate L_{inf} , Z/K , Z , annual reproductive rate (α), intrinsic rate of population increase (r_{max}), population doubling time (t_d), and fishing mortality associated with maximum sustainable yield (F_{msy}).

We assume that you have a set of length frequency data for this species and that you have a good idea about the maximum length (largest fish caught during the last 5 - 10 years) of your population. Note that this analysis is based on the assumption that the size distribution in your sample is similar to that of the population as a whole (see Note). In every step you can click on the 'Background' button for definitions of parameters and equations.

In the next step you will be asked to enter your Length Frequency data (go to 'Length frequencies', 'L-F Data' if you want to use data from FishBase).

Proceed

Exit

Background

Note: It is assumed here (1) that the L-F sample covers a wide range of lengths, (2) that gear selection is accounted for and (3) that the sizes of monthly samples are more or less equal if the total sample is accumulated over more than one month. Accumulated samples should include altogether at least 500 specimens. If L-F data stem from a single sample it should include at least 1000 specimens. A good sample would be accumulated over 6 or more months and include over 1500 specimens.

Frequency Distribution

LF Code 399	Sampling										Summation
MidLength	LF Wizard	LF Wizard	LF Wizard	LF Wizard	LF Wizard	LF Wizard	LF Wizard	LF Wizard	LF Wizard	LF Wizard	LF Wizard
3.75	1.0	0.0	0.0	0.0	0.0	0.0	1.0	3.0	1.0	1.0	7.0
4.25	11.0	1.0	6.0	1.0	1.0	0.0	3.0	25.0	0.0	14.0	62.0
4.75	44.0	20.0	31.0	11.0	9.0	10.0	17.0	40.0	2.0	24.0	208.0
5.25	69.0	116.0	55.0	32.0	18.0	29.0	32.0	50.0	12.0	28.0	441.0
5.75	22.0	150.0	112.0	37.0	10.0	83.0	62.0	55.0	15.0	51.0	597.0
6.25	10.0	148.0	102.0	82.0	57.0	83.0	62.0	18.0	27.0	24.0	613.0
6.75	1.0	65.0	24.0	61.0	65.0	49.0	24.0	8.0	37.0	14.0	348.0
7.25	9.0	6.0	5.0	24.0	35.0	44.0	19.0	33.0	91.0	6.0	272.0
7.75	53.0	7.0	40.0	8.0	24.0	29.0	11.0	61.0	96.0	24.0	353.0
8.25	52.0	36.0	80.0	6.0	43.0	5.0	19.0	43.0	12.0	38.0	334.0
8.75	78.0	50.0	48.0	28.0	38.0	21.0	33.0	22.0	17.0	55.0	390.0
9.25	31.0	48.0	44.0	48.0	26.0	31.0	34.0	4.0	25.0	29.0	320.0
9.75	18.0	21.0	20.0	22.0	7.0	40.0	60.0	2.0	61.0	20.0	271.0
10.25	9.0	7.0	6.0	10.0	7.0	22.0	27.0	1.0	80.0	3.0	172.0
10.75	9.0	3.0	7.0	3.0	5.0	14.0	17.0	1.0	60.0	1.0	120.0
11.25	0.0	1.0	2.0	3.0	3.0	7.0	5.0	0.0	27.0	0.0	48.0
11.75	0.0	4.0	0.0	3.0	2.0	5.0	4.0	0.0	4.0	0.0	22.0
12.25	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	5.0	0.0	7.0



Length-Frequency Analysis Wizard (*Limnothrissa miodon*)

Step 2: Data Entry

The maximum reported length for this species is 17 cm SL. The 'Max. age & size' table may contain additional maximum length values for different areas. Please enter the maximum length known for your population and the respective length type (TL = total length, SL = standard length, FL = fork length).

Maximum length: (cm)

Length type:

Please enter the mid-ranges of your length classes and the number of fish counted therein. Separate entries by a space and use point as decimal symbol (see example). [1]

Length (cm)	Frequency (n)
5.25	0
5.75	0
6.25	0
6.75	0
7.25	0
7.75	1
8.25	0
8.75	3
9.25	5
9.75	4
10.25	7
10.75	4
11.25	10
11.75	4
12.25	6
12.75	1
13.25	0
13.75	0
14.25	0
14.75	0
15.25	0

Example
52.5 12.0
57.5 14.0
62.5 23.0

Note: For the calculation of natural mortality in Step 7 we need the length type in TL. For some species such as tunas the difference between TL and FL is small, and thus FL data can be treated as TL. Otherwise see our 'L-L relationship' table for conversions of length types.

Length-Frequency Analysis Wizard (*Limnothrissa miodon*)

Step 3: Length Frequency Graph

On the graph below you see a plot of your length frequency data with vertical lines indicating maximum length (Lmax), length at first maturity (Lm), and length with optimum yield (Lopt). Survey data from an unexploited population will usually show the highest peak of juvenile fishes at the left, followed by values fluctuating around a nearly straight line from the peak to maximum length on the X-axis, with a large proportion of mature and old fishes. Data from heavily exploited stocks will fluctuate around an exponentially declining curve from the first peak towards a value on the X-axis left of maximum length, and thus with only a small portion of mature and very few-if any-old fishes. In your sample 3.4% of the specimens had a chance to reproduce before being caught.

To avoid growth and recruitment overfishing, fisheries should strive to catch less juveniles, increase the number of fish that could spawn before being caught, and strive to only catch fish near the length with maximum yield (Lopt). The graph below can help to monitor progress towards such goals in subsequent years.

You can change the value for Lmax and recalculate Lopt. You can also replace the value for length at first maturity with a better estimate (preferably for females) and recalculate the number of mature specimens in the catch. Additional maturity values may be available in the 'Maturity' table.

Maximum length (Lmax): (cm)

Length with optimum yield (Lopt): (cm)

Length at first maturity (Lm): (cm)

Number of specimens in sample: 4,901

Number of mature specimens: 169 (3.4%)

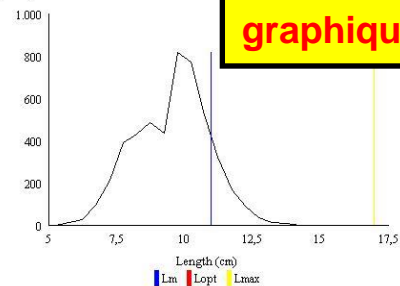
Number of specimens with optimum yield (Lopt +/- 10%): 2,711 (55.3%)

Number of Mega-specimens in catch (>= Lopt + 10%): 74 (1.5%)

Smallest fully selected length class (L): (cm)

Mean length (>= L) in sample (Lmean): 10.6 cm

Frequency



Note: If the first two peaks of your L-F sample are clear and well separated and likely to represent subsequent cohorts (fishes that are one year apart), you can use the length-difference between these peaks to estimate growth.

Linf: cm (asymptotic length estimated from Lmax)

L1: cm (length associated with first peak; X value of mouse-over)

L2: cm (length associated with second peak; X value of mouse-over)

delta t: years (time difference between L1 and L2, usually 1 year)

K: /year

If your L-F sample is aggregated from several individual samples you may want to do this calculation for every sub-sample and then take the mean value of K. You may change the value for delta t if the time between the peaks is different from 1, for example, delta t could be 0.5 if fish spawn twice per year, or 3 if you can identify the young-of-the-year and a peak representing an outstanding year class of 3 years earlier. Note that this is only a preliminary estimate of K, which you may want to compare with other estimates available for this species, or for closely related species of similar size.

Length-Frequency Analysis Wizard (*Limnothrissa miodon*)

FishBase

Step 4: Length-Weight Relationship

In this step we calculate the weight of the fish in your Length-Frequency sample. We use a length-weight relationship of the form $W=a*L^b$ from FishBase with the same length-type as in your sample, if available. You can replace the values for **a** and **b** if you have better estimates (length in cm, weight in g). Additional length-weight estimates for this species may be available in the 'Length-weight' table. If no length-weight relationship is available set $b=3.0$ and $a=0.1$ for short and round fishes, $a=0.01$ for normal fishes, and $a=0.001$ for eel-like fishes. In the following analysis the values for yield will then be only approximations, but peak in biomass, yield increase in percent, and preliminary exploitation rate will be correct.

a =

b =

Note: Values for L-W are required for proceeding.

relation longueur-poids

données de rendement actuelles

Length-Frequency Analysis Wizard (*Limnothrissa miodon*)

FishBase

Step 5: Actual Yield

Below we show your Length-Frequency data with actual yields in metric tons. The total yield of your sample is **0.20 tons**. Note that the **62.5 cm** length class produced the highest yield (**0.06 tons**) in your sample.

n = 6 (Number of Length Classes)

Length (cm)	Frequency	Yield (tons)
52.5	12	0.017156
52.5	12	0.017156
57.5	14	0.026505
57.5	14	0.026505
62.5	23	0.056326
62.5	23	0.056326

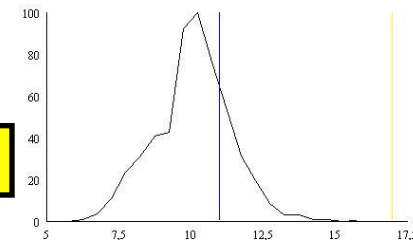
Note: If your frequency is not in absolute numbers, then the yield will be relative yield.

Length-Frequency Analysis Wizard (*Limnothrissa miodon*)

Step 6: Yield Graph

Below we show a graph of the yield (biomass) in your sample. Note that small fish usually do not contribute much to the yield. In an unfished or well-managed stock the peak of the yield curve will be close to L_{opt} . The greater the distance between the peak and L_{opt} , the larger the degree of growth and potentially recruitment overfishing. In your sample the yield peaks at **10.25 cm** length. This graph can be used to monitor the development of a fishery over several years.

Yield (% of largest value)



Length-Frequency Analysis Wizard (*Limnothrissa miodon*)

Step 7: Growth and Natural Mortality

To estimate exploitation rate from your data and the potential gain from a different fishing strategy you need to know the growth (Linf, K) and natural mortality (M) of your stock. Below we show values from FishBase, if available. You can replace these with your own values or use the [Life-history](#) tool to improve our estimates.

Lmax: 17 cm TL

Linf: cm TL

K: 1/year

M: 1/year

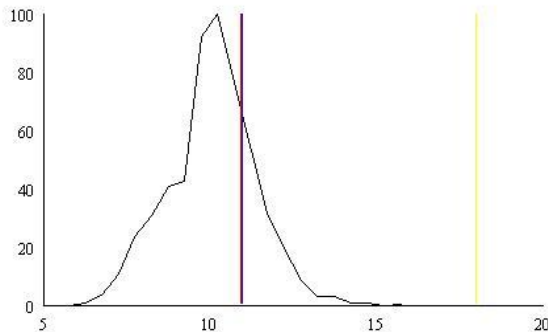
The subsequent calculation of preliminary exploitation rate (E) depends on a good estimate of Lopt (which we recalculate here from the growth and mortality values above) and the observed length class with maximum yield. You can replace our estimates below with your own.

Lopt length class: cm TL

Length class with maximum yield: cm

Age at first maturity: years

Yield (% of largest value)



Legend: Lm (blue), Lopt (red), Linf (yellow)

croissance et mortalité naturelle

Length-Frequency Analysis Wizard (*Limnothrissa miodon*)

FishBase

Step 8: Preliminary Exploitation Rate

The length class 62.5 cm with the highest yield in your L-F sample can be used to obtain a preliminary estimate of total mortality (Z) in your stock. Fishing mortality (F) is then obtained from $F=Z-M$, and the exploitation rate of $E=F/Z=1.97$ means that about **20%** of each generation of fish in your sample died from fishing. Exploitation rates of $E>0.5$ are considered unsustainable for most species and fisheries that include juveniles and adults. Note that if F is close to zero or negative then either your stock is unfished or your L-F sample is not suitable for this analysis.

Preliminary total mortality (Z): -1.39

Preliminary fishing mortality (F): -2.73

Preliminary exploitation rate (E): 1.97

We also provide the Beverton and Holt estimation of Z from $Z = K * (Linf - Lmean) / (Lmean - L')$ (see Step 3):

B & H total mortality (Z): -9.36

B & H fishing mortality (F): -10.70

B & H exploitation rate (E): 1.14

For advanced users we also provide an approach to estimate Linf, Z/K, Z, annual reproductive rate (alpha), intrinsic rate of population increase (rmax), population doubling time (td), and fishing mortality associated with maximum sustainable yield (Fmsy).

le taux d'exploitation



Length-Frequency Analysis Wizard (*Limnothrissa miodon*)

stratégie de pêche

Step 9: Fishing Strategy Background

Normally you can achieve much higher yields from your stock if you only catch fish with lengths around L_{opt} . This means you will not catch juveniles in order to let them realize their growth and spawning potential, and you will not catch very big adults, in order to benefit from their high fecundity and their good genes (reaching a large size and high age is an indicator of excellent 'fitness'). In the next steps we will calculate the gain in yield if such fishing strategy is applied. Note that such analysis does not make sense for new, unfished, or well managed stocks (peak of yield $\geq L_{opt}$) or Length Frequency samples that do not represent properly the size structure of the stock. Change Z below if you want to use the B & H estimate of $Z = -9.36$

The following parameters will be used for the subsequent calculations:

Linf: cm SL
 K: 1/year
 M: 1/year
 Z: 1/year
 Lopt: cm

Length-Frequency Analysis Wizard (*Limnothrissa miodon*)

FishBase

Step 10: Calculation of Potential Yield

In this step we calculate the potential yield if you only catch fish around L_{opt} at an average length of **10.7 cm**, which corresponds to an age of **1.4 years**. Thus, the column 'Potential Freq.' contains the number of fish in each length class that will survive to reach **1.4 years**, and the column 'Potential Yield' contains the contribution of the respective length class to the total potential yield. Note that the numbers in 'Potential Freq.' are lower than the numbers in 'Frequency', due to natural mortality. However, the survivors should nevertheless produce a higher yield.

n = 6 (Number of Length Classes)

Length (cm)	Frequency	Actual Yield (tons)	Potential Freq.	Potential Yield (tons)
52.5	12.0	0.017156	0.0	0.000000
52.5	12.0	0.017156	0.0	0.000000
57.5	14.0	0.026505	0.0	0.000000
57.5	14.0	0.026505	0.0	0.000000
62.5	23.0	0.056326	0.0	0.000000
62.5	23.0	0.056326	0.0	0.000000

calcul de rendement potentiel

Length-Frequency Analysis Wizard (*Limnothrissa miodon*)

FishBase

Step 11: Comparison of Actual Yield with Potential Yield

Below you see the comparison between the actual yield represented by your Length Frequency sample, and the potential yield if these fish had been allowed to survive to a length around L_{opt} . If your Length Frequency sample was representative of the stock, then the difference in yield expressed in percent will give you a first estimate of how much more protein and income can be derived from your fishery. Also, most fish had a chance to reproduce before being caught and **86 'mega-spawners'** were allowed to survive. This should stabilize recruitment and further increase catches in subsequent years. Note, however, that it will take approximately **1.4 years** until the higher yield is achieved, and that especially in the first years after implementing the new fishing strategy yields may be significantly lower and fishers may need external support during that period.

Actual yield:	0.199972 tons
Potential yield:	0.000000 tons
Difference:	-0.200 tons (see Note if negative)
Difference:	-100.0 %

Note: If the difference between Actual yield and Potential yield is negative, then most likely your L-F sample is not representative of the stock (see Note in Step 1). Other reasons could be that your population is unfished, that your growth or mortality estimates are unrealistic, or that fish are already caught at L_{opt} .

Below we repeat all relevant parameters of this analysis for easy documentation (just print this page).

Linf:	18.0	Lm:	11.2
K:	0.65	tm:	1.21
\emptyset :	2.32	Lopt:	10.70
to:	-0.29	M:	1.34
Z:	-1.39	F:	-2.73
E:	1.97		

rendement actuel
&
rendement potentiel

Croissance

More information

Countries	Common names	Age/Size	References	Collaborators
FAO areas	Synonyms	Growth	Aquaculture	Pictures
Ecosystems	Metabolism	Length-weight	Aquaculture profile	Stamps, Coins
Occurrences	Predators	Length-length	Strains	Sounds
Introductions	Ecotoxicology	Length-frequencies	Genetics	Ciguatera
Stocks	Reproduction	Morphometrics	Allele frequencies	Speed
Ecology	Maturity	Morphology	Heritability	Swim. type
Diet	Spawning	Larvae	Diseases	Gill area
Food items	Fecundity	Larval dynamics	Processing	Otoliths
Food consumption	Eggs	Recruitment	Mass conversion	Brains
Ration	Egg development	Abundance	Vision	

Growth of *Oreochromis esculentus*

Auximetric graph Lm vs Linf graph M vs Linf graph
 Lm vs Linf graph M vs K graph
 (loading of graphs may take 2-3 min.)

Main Ref.:	787	Data Ref.:	787
Data Type:	scale annual rings		
Sex:	unsexed		
L infity (cm):	32.0 TL	95% confidence limit:	
K (1/y):	0.50 Ford/Walford plot	n:	r ² : 95% confidence limit:
to (y):			95% confidence limit:
Winf.:	616.00 g	other(see comments):	b used :3.000
C:			Ø' : 2.71
M (1/y):	1.750 M Ref. :1795 M doubtful?	n:	r ² : 95% confidence limit:
Lm (cm):	22.0	0.69	Unsexed TL Lm Ref. : 787
Locality:	Lake Victoria, Kavirondo Gulf		
Country:	Kenya		
Environment:	open waters		
Temp.:	25.0	Temp. Ref.:	
Comment:	Winf from Ref. 115		

Growth parameters for *Oreochromis esculentus*

Maximum Length 50cm SL n = 20
 Note that studies where Loo is very different (+/- 1/3) from Lmax are doubtful.
 ø = 3.12 Median record no. 11
 L Inf = 12.9 cm SL 102Ref. 102
 K = 8.0

	Loc (cm)	Length Type	K (1/y)	to (years)	Sex	M (1/y)	Temp° C	Lm	Ø'	Country	Locality	Questionable	Captive
<input type="checkbox"/>	6.4	TL	0.96				22.5	1.59			aquarium	No	Yes
<input type="checkbox"/>	8.0	TL	1.02				22.5	1.81			aquarium	No	Yes
<input type="checkbox"/>	9.0	TL	1.89				22.5	2.18			aquarium	No	Yes
<input type="checkbox"/>	9.5	TL	1.02				22.5	1.96			aquarium	No	Yes
<input type="checkbox"/>	10.1	TL	3.80				22.5	2.59			large aquarium	No	Yes
<input type="checkbox"/>	10.5	TL	2.03				22.5	2.35			aquarium	No	Yes
<input type="checkbox"/>	12.2	TL	0.91				22.5	2.13			aquarium	No	Yes
<input type="checkbox"/>	12.4	TL	2.87				22.5	2.64			aquarium	No	Yes
<input type="checkbox"/>	12.5	TL	2.22				22.5	2.54			aquarium	No	Yes
<input type="checkbox"/>	12.8	TL	3.29				22.5	2.73			small aquarium	No	Yes
<input type="checkbox"/>	12.9	SL	7.96					3.12		Tanzania	ponds	No	Yes
<input type="checkbox"/>	16.3	TL	0.79				22.5	2.32			aquarium	No	Yes
<input type="checkbox"/>	25.1	TL	0.43				22.5	2.43			aquarium	No	Yes
<input checked="" type="checkbox"/>	25.2	SL	0.35					2.35		Zimbabwe	Luapula Moero	No	No
<input checked="" type="checkbox"/>	26.7	SL	0.45				25.5	2.51		Tanzania	Lake Victoria	No	No
<input type="checkbox"/>	30.8	TL	0.26				22.5	2.38			aquarium	No	Yes
<input checked="" type="checkbox"/>	32.0	TL	0.50			1.75	25.0	22.0	2.71	Kenya	Lake Victoria, Kavirondo Gulf	No	No
<input checked="" type="checkbox"/>	32.4	TL	0.31				25.0	26.0	2.51	Tanzania	Lake Victoria, Mwanza Area	No	No
<input checked="" type="checkbox"/>	33.5	TL	0.31				25.0	2.54		Kenya	Lake Victoria, outside Kavirondo Gulf	Yes	No
<input checked="" type="checkbox"/>	33.8	TL	0.32				25.0	25.0	2.56	Uganda	Lake Victoria, Jinja Area	No	No

Croissance

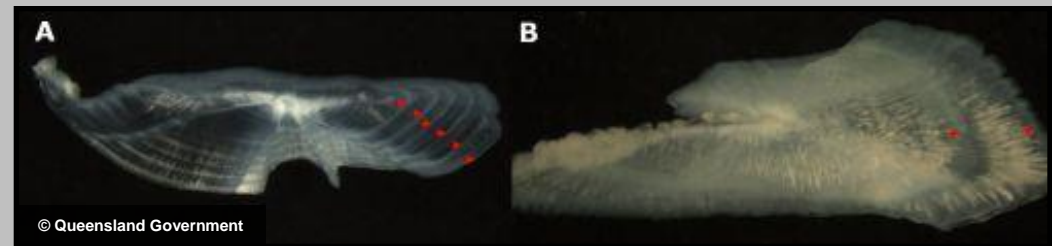
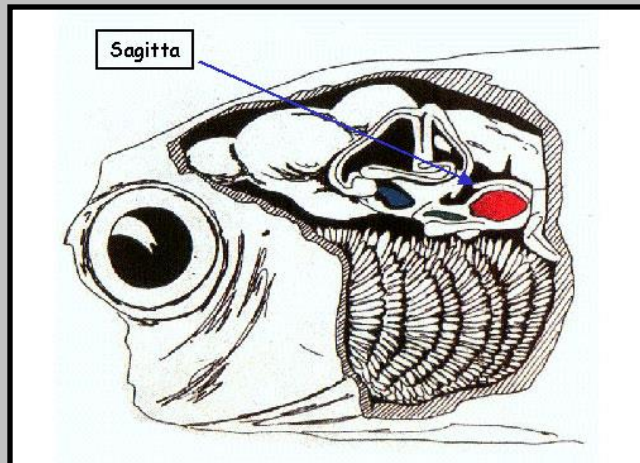
Growth of *Oreochromis esculentus*

Auximetric graph Lm vs Linf graph M vs Linf graph
 Lm vs Linf graph M vs K graph
 (loading of graphs may take 2-3 min.)

Main Ref. :	787			Date Ref. :	787
Data Type :	scale annual rings				
Sex :	unisexed				
L infinity (cm) :	32.0 TL				95% confidence limit:
K (1/y) :	0.50 Ford/Walford plot	n :		r² :	95% confidence limit:
to (y) :					95% confidence limit:
Winf. :	616.00 g	other(see comments) :3.000	b used	g' : 2.71	
C :					
M (1/y) :	1.750 M Ref. :1795 M doubtful? plot of Z on effort	n :		r² :	95% confidence limit:
Lm (cm) :	22.0	0.69	Unsexed TL	Lm Ref. : 787	
Locality :	Lake Victoria, Kavirondo Gulf				
Country :	Kenya				
Environment :	open waters				
Temp. :	25.0	Temp. Ref. :			
Comment :	Winf from Ref. 115				

Il y a différentes données de base utilisées pour l'estimation de croissance:

- 1/ annuli d'otolithe.
- 2/ annuli d'écaille.
- 3/ autres marques annuelles.
- 4/ anneaux d'otolithe journaliers.
- 5/ marquage / recapture.
- 6/ distribution de fréquences de longueur.
- 7/ observation directe.
- 8/ plusieurs types de données.
- 9/ autres.



Croissance

Growth of *Oreochromis esculentus*

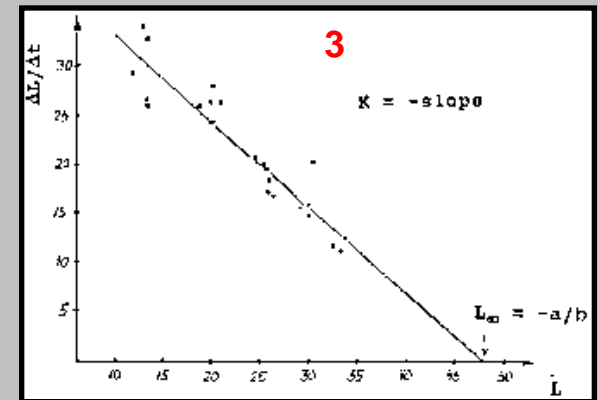
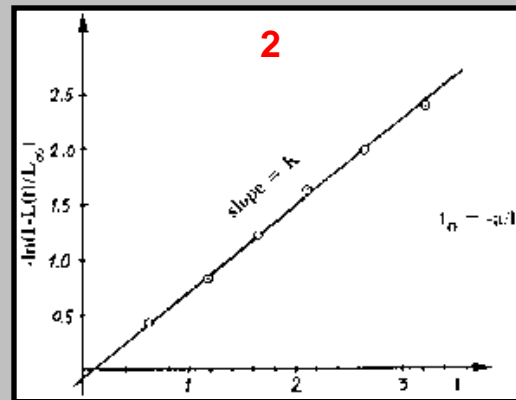
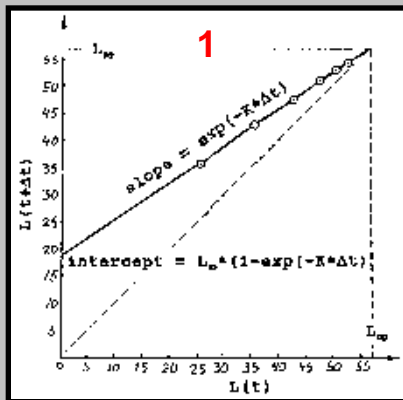
Auximetric graph Lm vs Linf graph M vs Linf graph
 Lm vs Linf graph M vs K graph
 (loading of graphs may take 2-3 min.)

Main Ref.:	787	Data Ref.:	787
Data Type:	scale annual rings		
Sex:	unsexed		
L infinity (cm):	22.0 TL	95% confidence limit:	
K (1/y):	0.50 Ford/Walford plot	n:	r ² : 95% confidence limit:
Winf.:	616.00 g	other(see comments) b used :3.000	φ' : 2.71
C:			
M (1/y):	1.750 M Ref. :1795 M doubtful? plot of Z on effort	n:	r ² : 95% confidence limit:
Lm (cm):	22.0	0.69	Unsexed TL Lm Ref. : 787
Locality:	Lake Victoria, Kavirondo Gulf		
Country:	Kenya		
Environment:	open waters		
Temp.:	25.0	Temp. Ref. :	
Comment:	Winf from Ref. 115		

Il y a différentes méthodes pour estimer certaines données de paramètres de croissance:

- 1/ modèle de Ford-Walford.
- 2/ modèle de von Bertalanffy/Beverton.
- 3/ modèle de Gulland & Holt.
- 4/ régression non-linéaire.
- 5/ ELEFAN.
- 6/ autre(s) méthode(s).

Voir p.e. Bougis (1976), Ricker (1980), Gulland (1983), Pauly (1984, 1997), Gayanilo & Pauly (1997), et d'autres publications halieutiques pour des descriptions de ces méthodes, de leurs hypothèses sous-jacentes, de la conformité des données et de leurs biais.



Croissance

Growth of *Oreochromis esculentus*

Auximetric graph Lm vs Linf graph M vs Linf graph
Lm vs Linf graph M vs K graph
(loading of graphs may take 2-3 min.)

Main Ref.:	787	Data Ref.:	787
Data Type:	scale annual rings		
Sex:	unsexed		
L infinity (cm):	32.0 TL	95% confidence limit:	
K (1/y):	0.50 Ford/Walford plot	n:	r ² :
ln (y):			95% confidence limit:
Winf.:	616.00 g	other(see comments): 3.000	b used ø' : 2.71
M (1/y):	1.750 M Ref. :1795 M doubtful? plot of Z on effort	n:	r ² :
Lm (cm):	22.0	0.69	Unsexed TL Lm Ref. : 787
Locality:	Lake Victoria, Kavirondo Gulf		
Country:	Kenya		
Environment:	open waters		
Temp.:	25.0	Temp. Ref. :	
Comment:	Winf from Ref. 115		

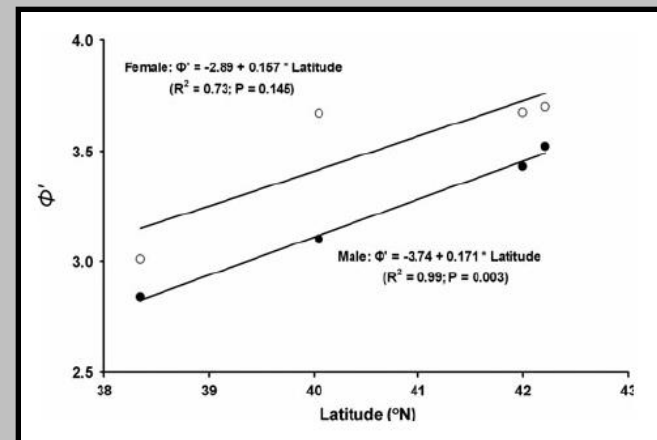
Le calcul de W_{∞} en fonction de L_{∞} parmi les choix suivants:

- 1/ comme indiquée dans MainRef. ou Ref. pour la croissance.
- 2/ calcul par relation L/W du même stock.
- 3/ calcul par relation L/W d'un stock différent de la même espèce.
- 4/ calcul par relation L/W d'une espèce similaire.
- 5/ autres (voir Commentaires).

ϕ' = l'indice de performance de croissance.

C'est pour la comparaison de l'indice ϕ' d'autres stocks de l'espèce, ou des espèces étroitement apparents.

$$\phi' = \log_{10}K + 2 \log_{10}L_{\infty}$$



Croissance

Growth of *Oreochromis esculentus*

Auximetric graph Lm vs Linf graph M vs Linf graph
Lm vs Linf graph M vs K graph

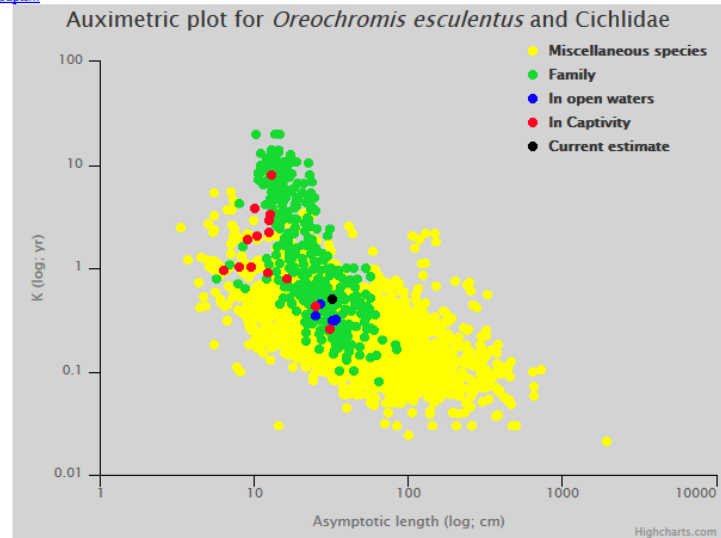
(loading of graphs may take 2-3 mins)

Main Ref. :	787	Data Ref. :	787
Data Type :	scale annual rings		
Sex :	unsexed		
L infinity (cm) :	32.0 TL		
K (1/y) :	0.50	Ford/Walford plot	n: r ² : 95% confidence limit:
to (y) :	95% confidence limit:		
Winf. :	616.00 g	other(see comments) :3.000	b used ø' : 2.71
C :			
M (1/y) :	1.750	M Ref. :1795	M doubtful? n: r ² : 95% confidence limit:
	plot of Z on effort		
Lm (cm) :	22.0	0.69	Unsexed TL Lm Ref. : 787
Locality :	Lake Victoria, Kavirondo Gulf		
Country :	Kenya		
Environment :	open waters		
Temp. :	25.0	Temp. Ref. :	
Comment :	Winf from Ref. 115		

Il est possible de faire un modèle auximétrique des paramètres de croissance (K en fonction de L_{∞} , sur base logarithmique).

- Comparaisons possibles avec d'autres espèces diverses, espèces de la même famille ou espèces courantes.
- Possibilité de changer les paramètres de croissance et de refaire le graphique

[About this graph...](#)



[n = 20; mean K = 0.96; Linf = 16.14]
In Captivity [n = 14]; In Open Waters [n = 6]
Add estimate: K = Linf =

[Growth parameters list](#)
[Back to Search](#)

Croissance

Growth of *Oreochromis esculentus*

[Auximetric graph](#)
[Lm vs Linf graph](#)
[M vs Linf graph](#)
[Lm vs Linf graph](#)
[M vs K graph](#)

(loading of graphs may take 2-3 mins)

Main Ref.:	787	Data Ref.:	787
Data Type:	scale annual rings		
Sex:	unsexed		
L infinity (cm):	32.0 TL		
K (1/y):	0.50	Ford/Walford plot	n:
to (y):			r ² :
Winf.:	616.00 g	other(see comments)	b used
C:		:3.000	Ø' : 2.71
M (1/y):	1.750	M Ref. :1795	M doubtful?
	plot of Z on effort	n:	r ² :
Lm (cm):	22.0	0.69	Unsexed TL
Locality:	Lake Victoria, Kavirondo Gulf		
Country:	Kenya		
Environment:	open waters		
Temp.:	25.0	Temp. Ref. :	
Comment:	Winf from Ref. 115		

Il est possible de faire un modèle auximétrique des paramètres de croissance (K en fonction de L_{∞} , sur base logarithmique).

- Comparaisons possibles avec d'autres espèces diverses, espèces de la même famille ou espèces courantes.
- Possibilité de changer les paramètres de croissance et de refaire le graphique

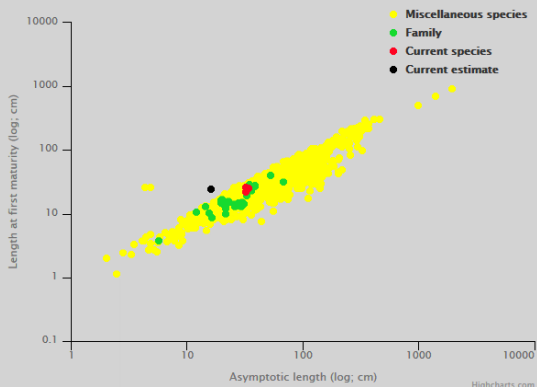
[About this graph...](#)

Auximetric plot for *Oreochromis esculentus* and Cichlidae



[About this graph...](#)

Lm vs Linf graph for *Oreochromis esculentus* and Cichlidae

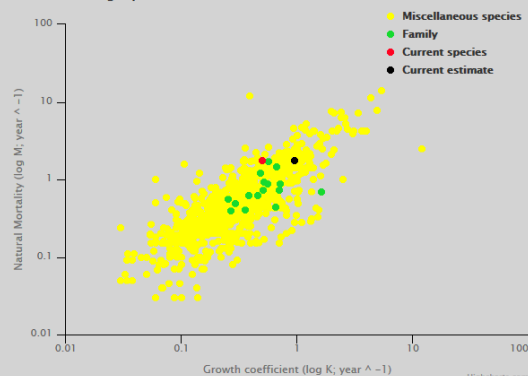


[n = 3; mean Lm = 24.27; Linf = 16.1]
 Add estimate: Lm = Linf =

[Growth parameters list](#)
[Back to Search](#)

[About this graph...](#)

M vs K graph for *Oreochromis esculentus* and Cichlidae

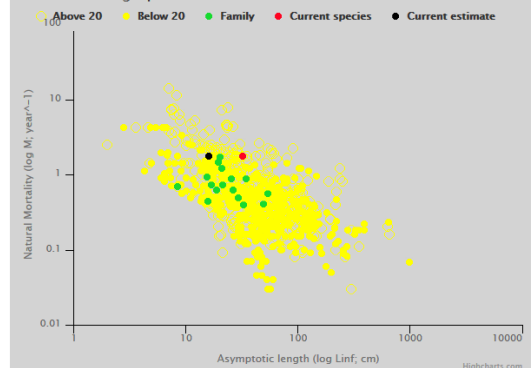


[n = 1; mean M = 1.75; K = 0.96]
 Add estimate: M = K =

[Growth parameters list](#)
[Back to Search](#)

[About this graph...](#)

M vs Linf graph for *Oreochromis esculentus* and Cichlidae



[n = 1; mean M = 1.75; Linf = 16.1]
 Miscellaneous species above 20°C (n = 325); Below 20°C (n = 496)
 Add estimate: M = Linf =

[Growth parameters list](#)
[Back to Search](#)

L'outil de dynamique de population rassemble les différents paramètres sur le dynamisme de population, tels que croissance, taille à la première maturité,...

Il utilise par défaut les 'meilleures' données disponibles dans FishBase pour les diverses équations. Les utilisateurs peuvent remplacer ces 'défauts' par leurs propres estimations et recalculer les paramètres.

Tools
E-book | Field guide | Length-frequency wizard | **Life-history tool** | Point map | Classification Tree | Catch-MSY

Life History Data on *Oreochromis esculentus* Singida tilapia

Family:	Cichlidae	Cichlids
Max. length (Lmax):	50.0	cm SL
L infinity (Linf):	= 32.2	cm TL
K:	0.45 /year	$\phi' = 2.67$ Median ϕ' value with related Linf. and K.
to:	-0.36	years Estimated from Linf and K.
Natural mortality (M):	0.91	s.e. 0.60 - 1.38 /year Estimated from Linf., K and annual mean temp. = 25.5 °C
Life span (approx.):	6.3	years Estimated from Linf., K and to. Max. age & size data
Generation time:	1.8	years Estimated from Lopt, Linf., K and to.
Age at first maturity (tm):	1.6	years Estimated from Lm, Linf., K and to.
L maturity (Lm):	18.9	s.e. 14.1 - 25.3 cm TL Estimated from Linf. Maturity data
L max. yield (Lopt):	19.8	s.e. 16.8 - 23.4 cm TL Estimated from Linf.
Length-weight:	32.2	cm TL => 668.3 g (wet weight) W = 0.0194 * L ^ 3.00900
Nitrogen & protein:	Weight 669 (g)	=> whole-body nitrogen (N) 18.2 (g) => whole-body crude protein 113.6 (g)
Reproductive guild:	bearers: external brooders	Reproduction
Fecundity:	[no value (min.)-no value (max.)]	Estimated as geometric mean. Fecundity

Relative Yield per Recruit (Y/R):	0.0277	Estimate Y/R from M/K, Lc/Linf and E. Lc = 12.9 cm TL E = 0.50 /year Emsy 0.65 /year Eopt 0.57 /year Fmsy 1.69 /year Fopt 1.21 /year
Exploitation:	Z = F = E =	Estimate Z, F, E from Lc, Lmean, Linf, K, M Lc = 12.9 cm TL Lmean = cm TL
Resilience / productivity:	High; decline threshold 0.99 Vulnerable to extinction if decline in biomass or numbers exceeds threshold over the longer of 10 years or 3 generations.	
Intrinsic rate of increase (rm):	3.38 /year	Lr = 12.9 cm TL Estimated from Fmsy at Lc = length of recruitment (Lr).
Main food:	mainly plants/detritus (troph. 2-2.19)	Food
Trophic level:	2.5 +/- s.e. 0.17	Estimated from food data.
Food consumption (Q/B):	20.7 times the body weight per year	Enter Winf, temperature, aspect ratio (A), and food type to estimate Q/B Winf = 668.3 g Temp. = 25.5 °C A = 1.32 Detrivore Herbivore Omnivore Carnivore
Estimate growth		
Note: The estimates are derived from default values taken from FishBase and will thus not be appropriate for every population. You can change these values and recalculate the life history parameters.		

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Plus d'info:

- FAO Fisheries Technical Paper 306: Introduction to tropical fish stock assessment.
- Christensen, V. & J. MacLean (2011) Ecosystem approach to fisheries. Cambridge University Press, Cambridge. 325 p.
- Pauly, 1997 (adaption française par J. Moreau) Méthodes pour l'évaluation des ressources halieutiques. Editions CEPADUES, Toulouse. 288 p.

